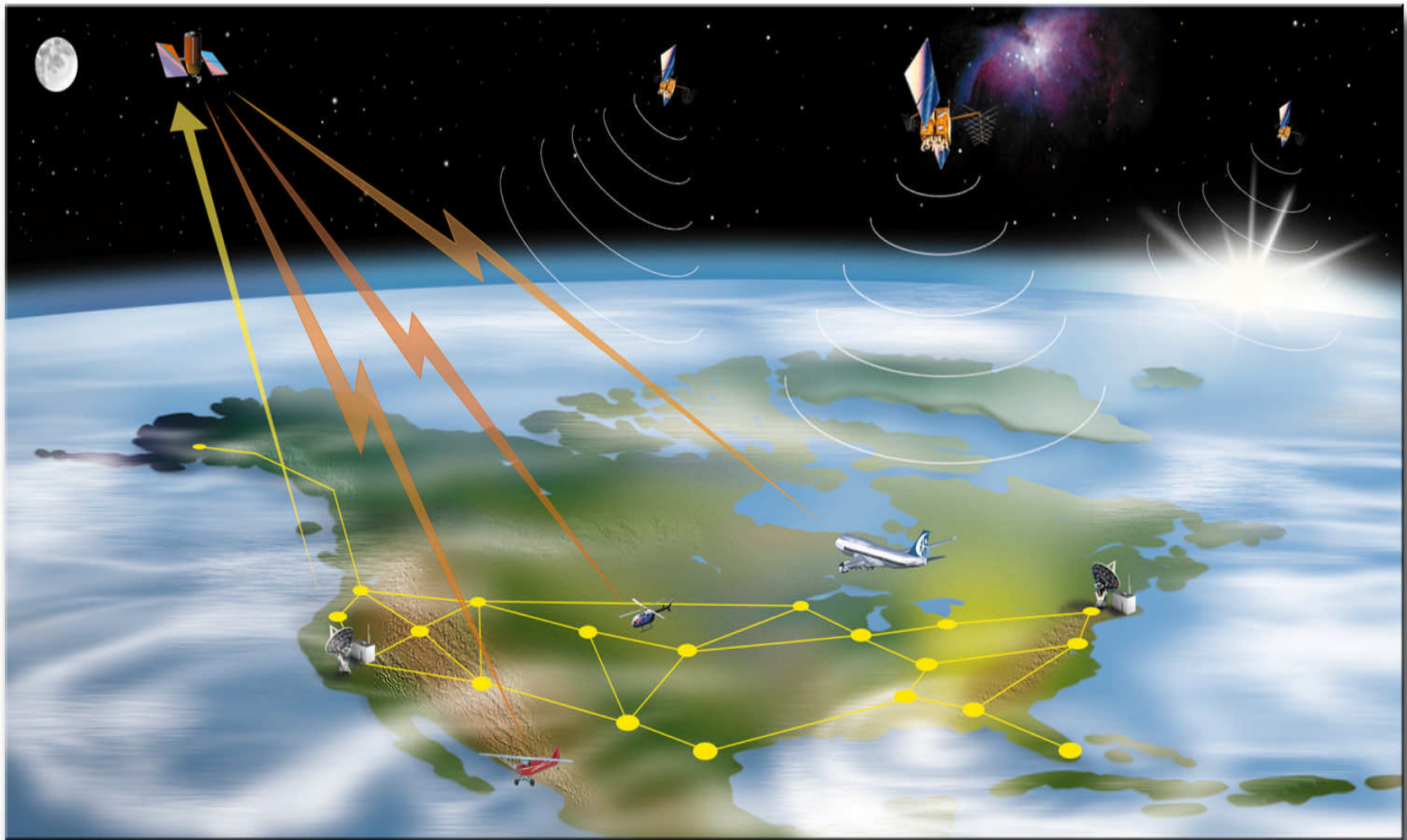


NASA Avionics Conference CNS in the National Airspace System



**Mike Harrison, Director
Architecture and Systems Engineering
Federal Aviation Administration
April 30, 2002**

NAS Evolution Toward Greater Complexity

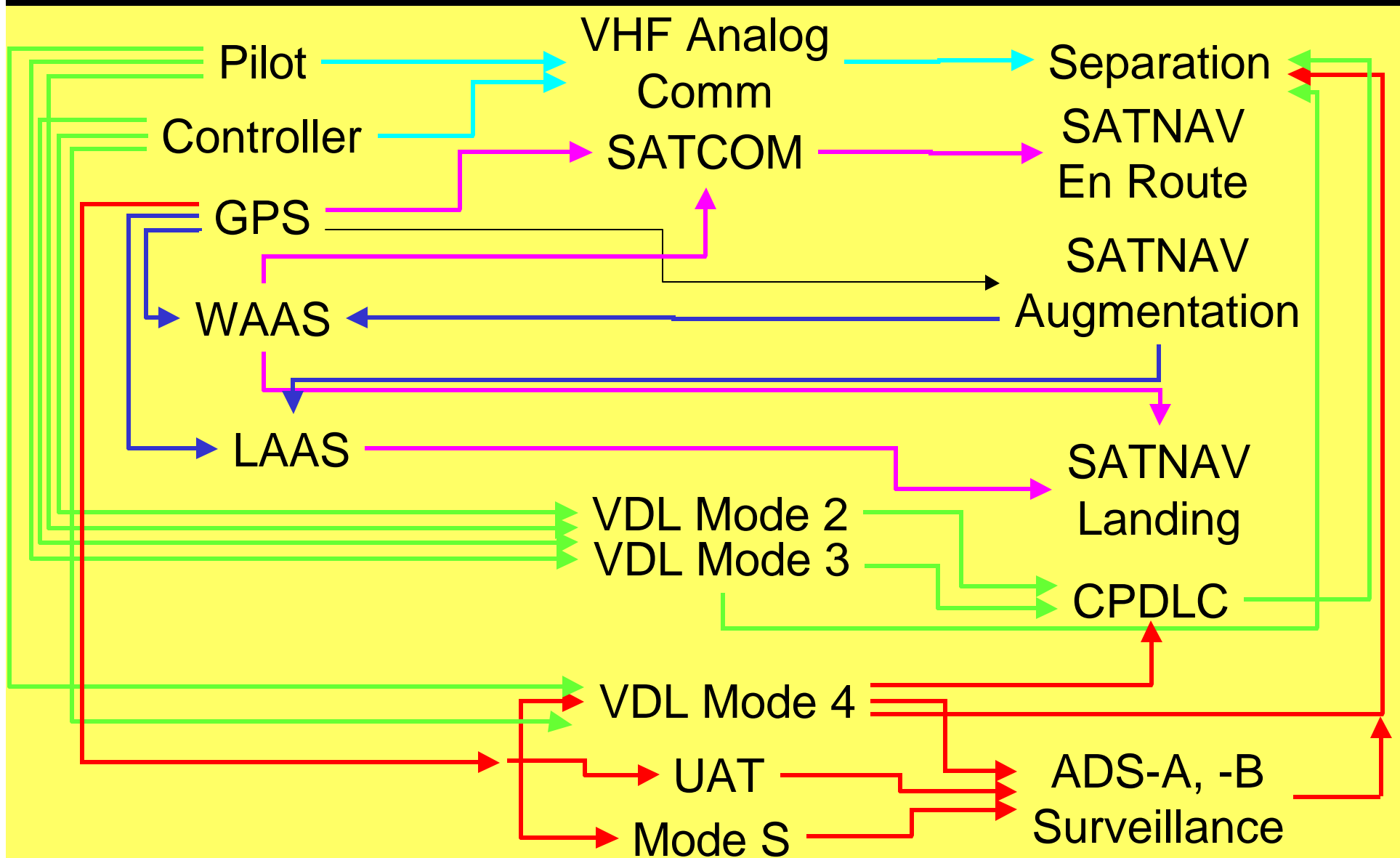


Toward Greater Complexity

Information
Source

Pipe

Application



Evolution of CNS

C – toward digital that carries a greater mix of services and capabilities

N – toward satellite navigation with a ground-based backup

S – toward a mix of primary and secondary radar with addition of multi-lateration and Automated Dependent Surveillance

Automatic – Broadcast - Contract

Problem:

- Too Many CNS Capabilities Available
- Too Little Implementation to Produce Benefits
- Difficult Business Cases
- Benefits Accrue to the Unequipped
- Who Wants to Buy Avionics?

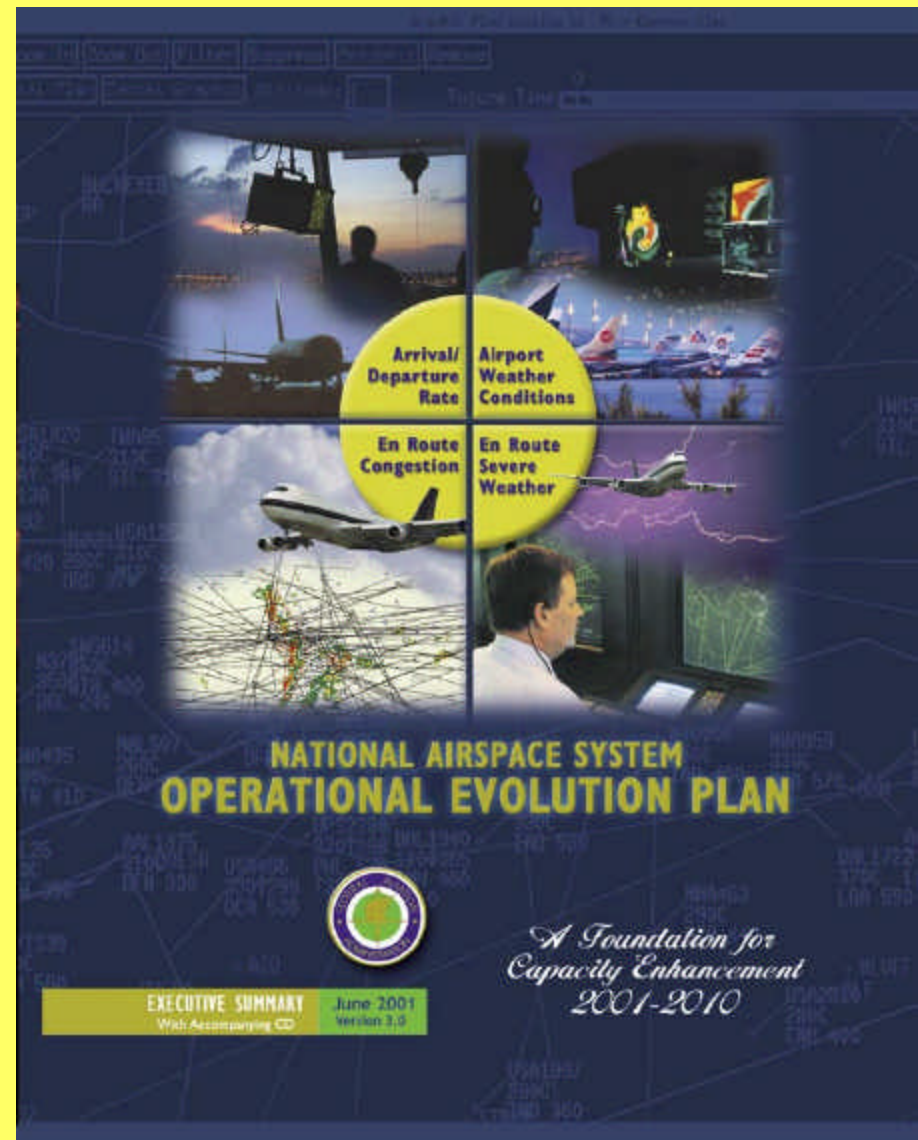
Waste of Scarce National Resources to Invent New CNS

Shift Focus to Mining Capabilities and Benefits From Currently Planned Avionics – Add to the Business Case

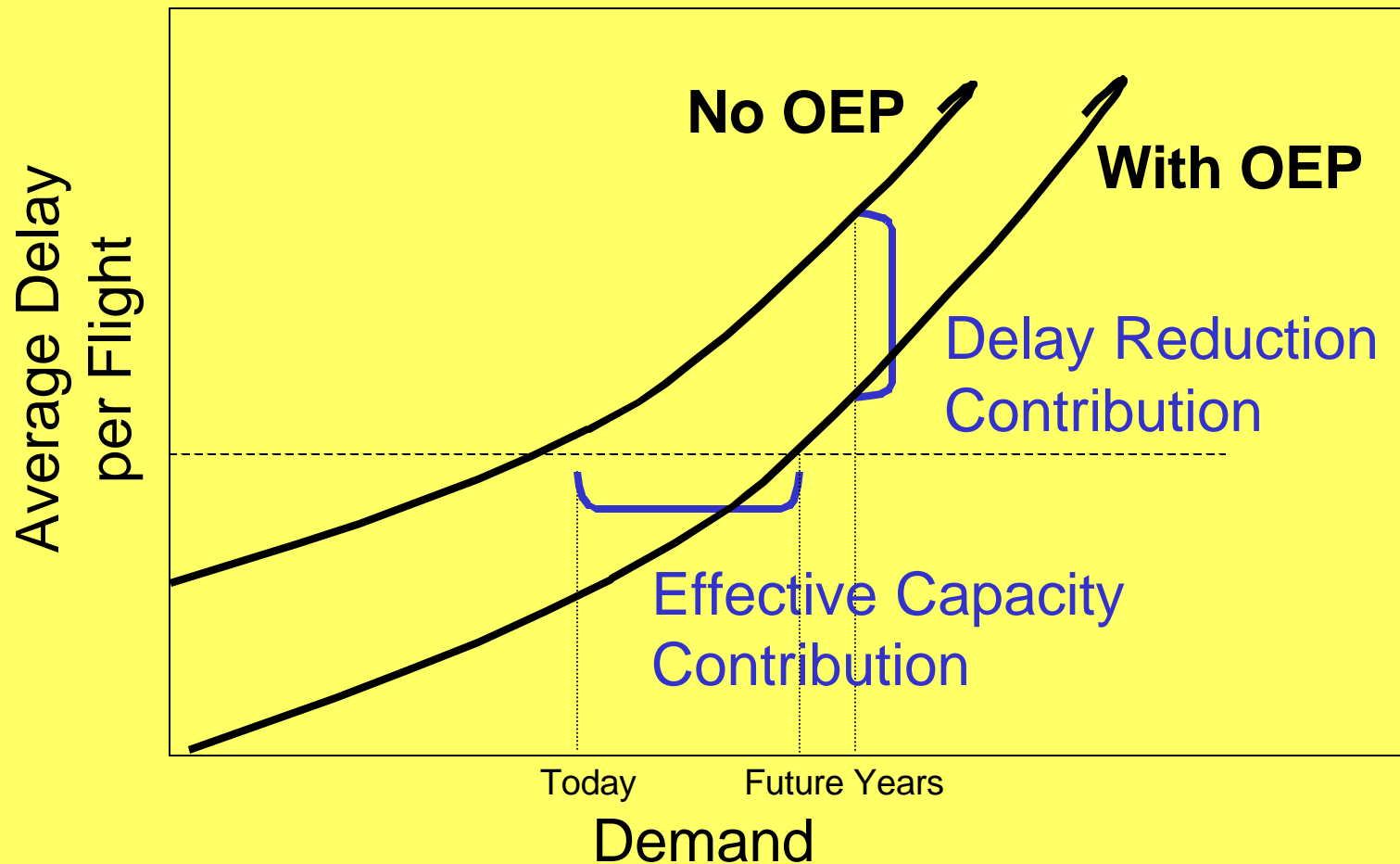
Operational Evolution Plan Sets Priorities for Capacity and Efficiency

**30 Percent
Improvement
Target by 2010**

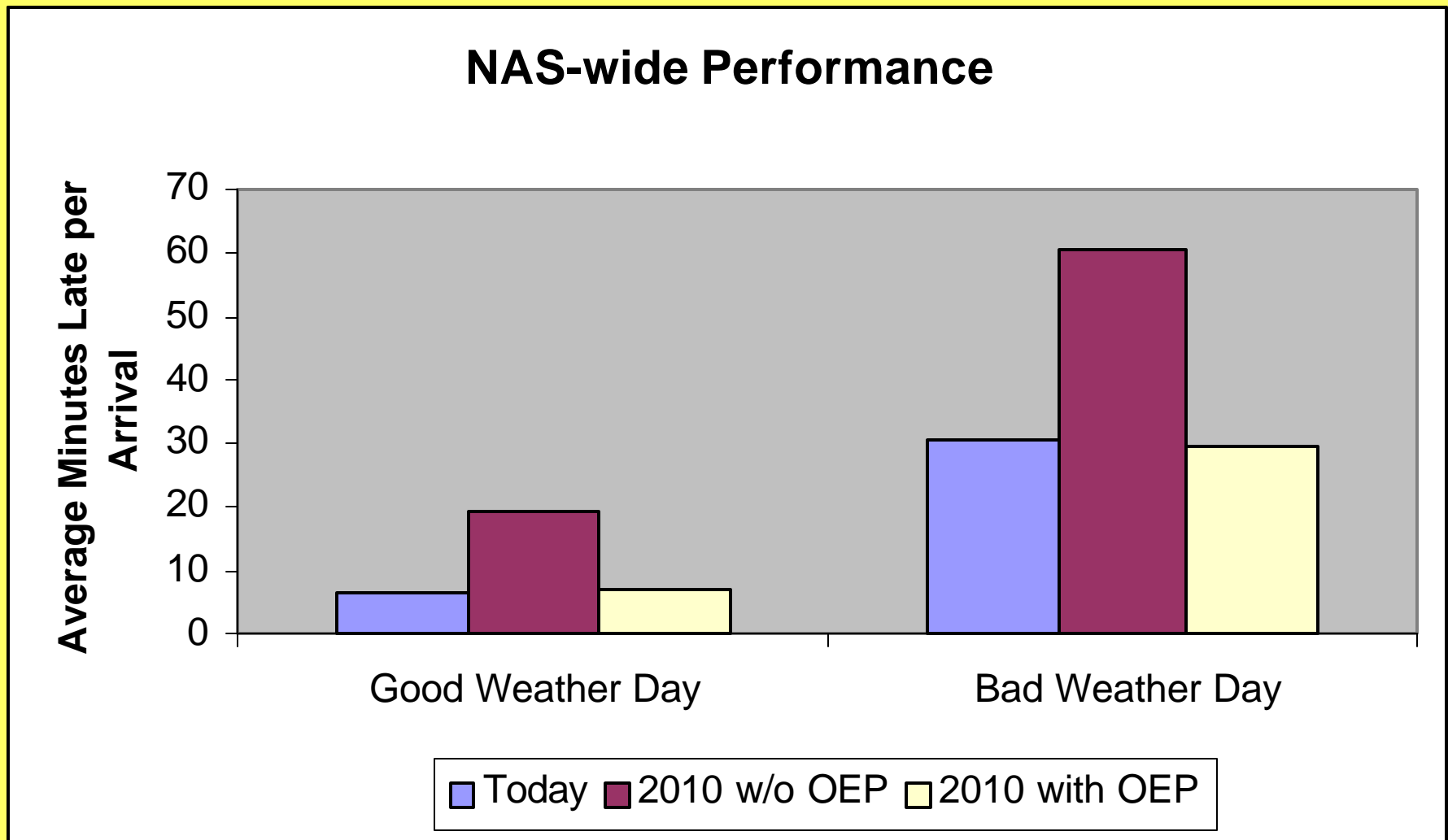
www.faa.gov



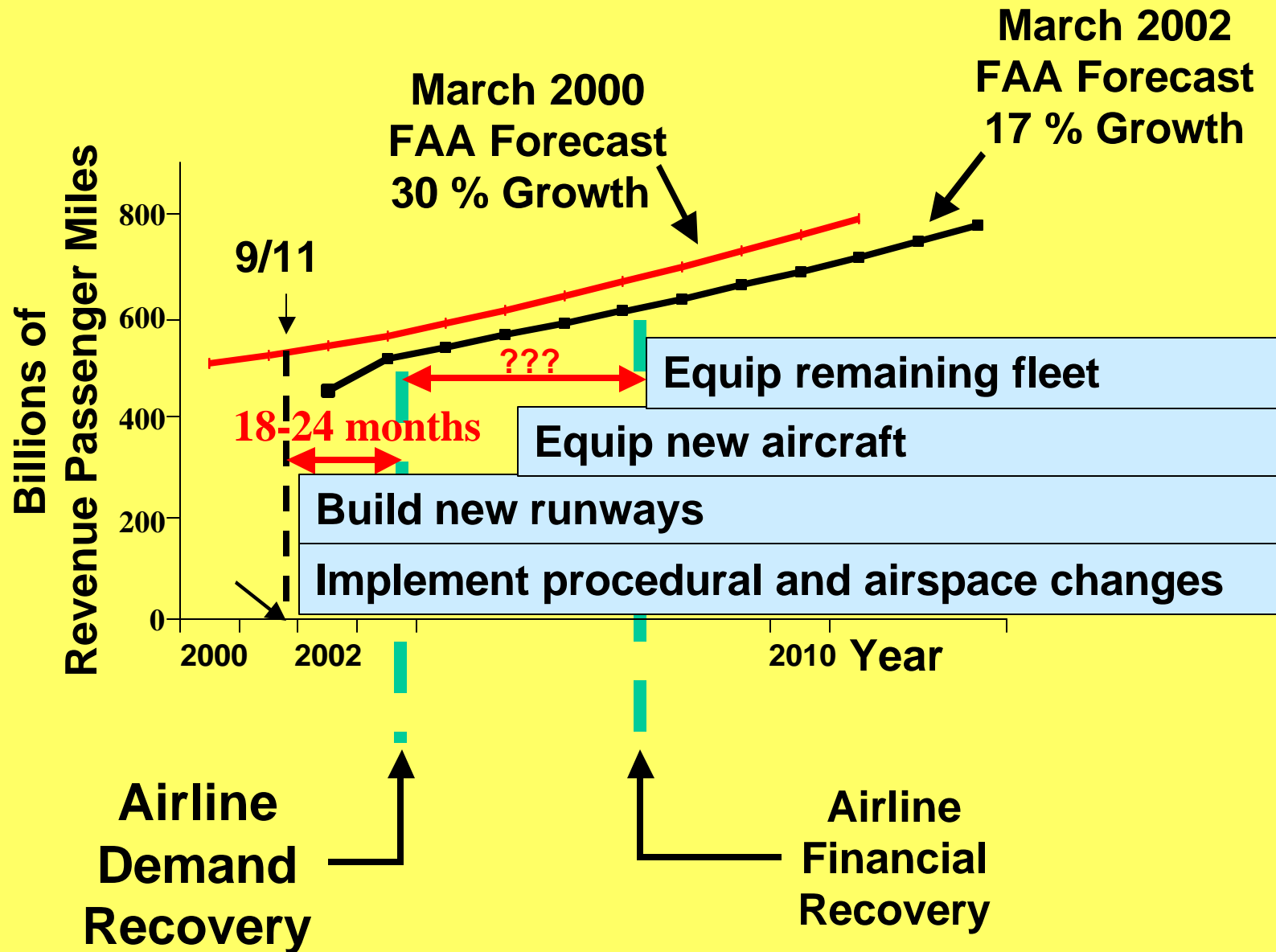
Understanding System Performance: Handling 30% More Traffic by 2010



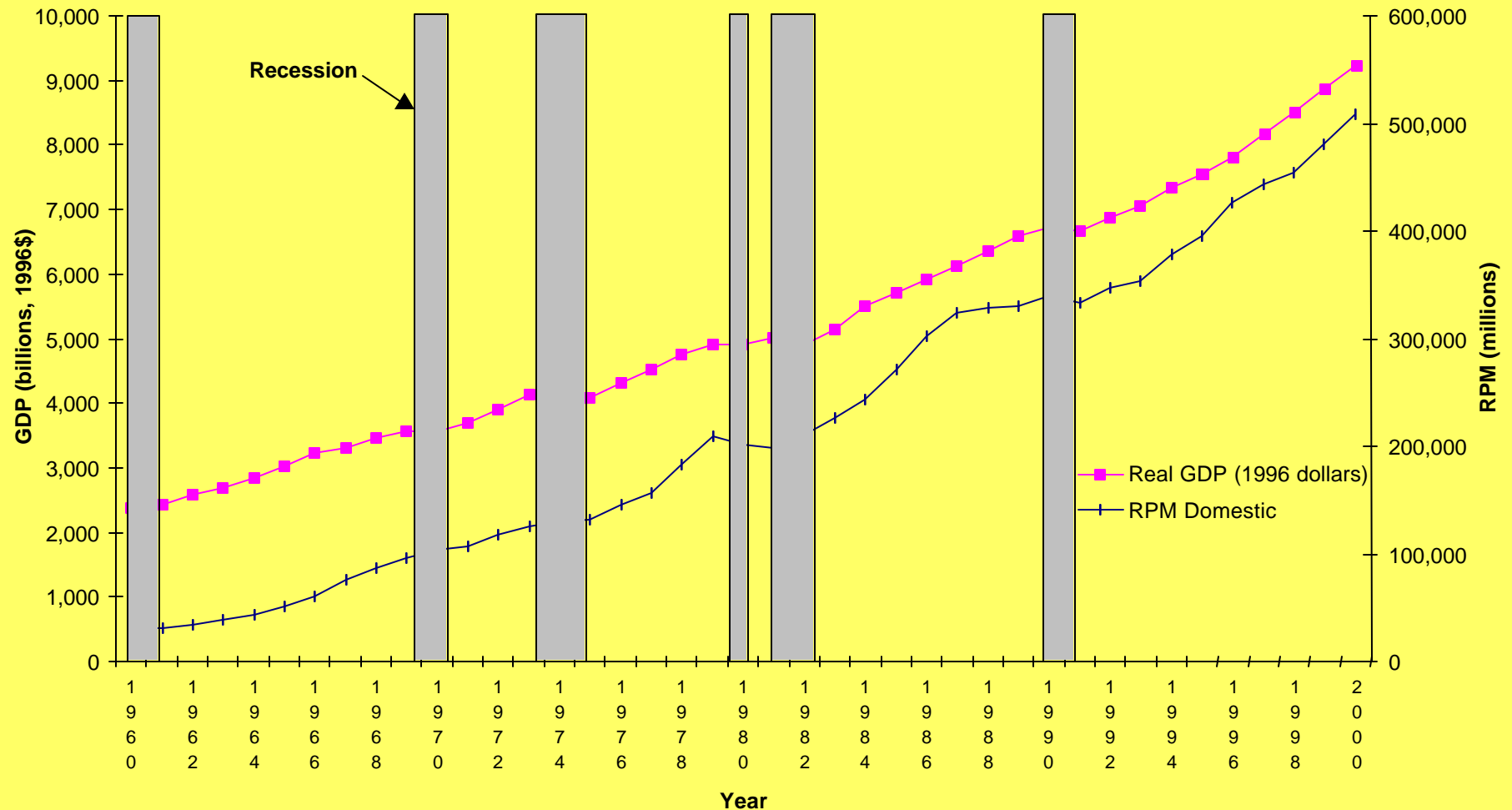
OEP Holds National Performance Constant Even with about 30% Increase in Demand



OEP Implementation Strategy

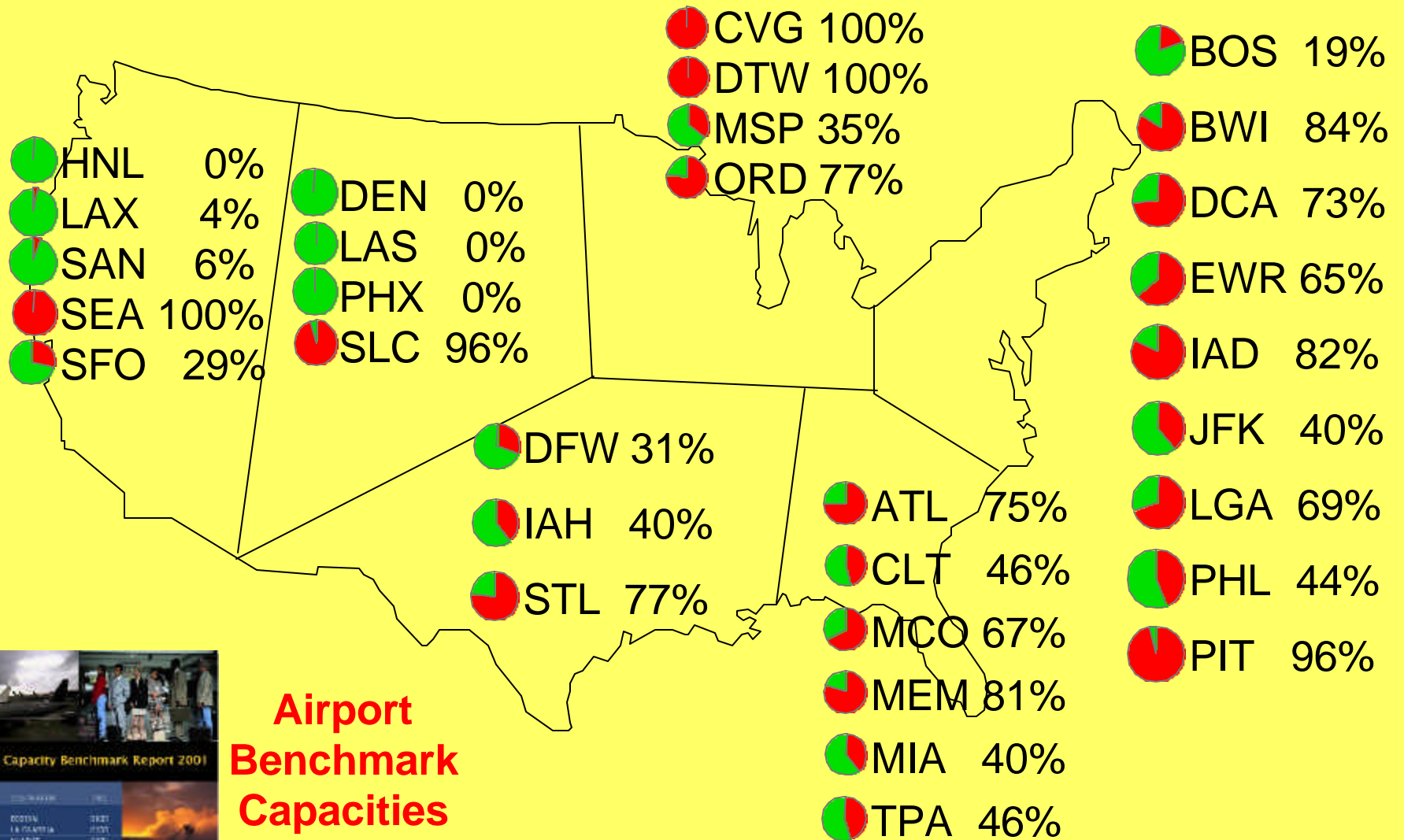


GDP and Domestic RPM: 1960-2000



RPM data from Air Transport Association
 GDP data from Bureau of Economic Analysis, DOC
 Recession markings from Dow Jones (approximate)

Percent of the Day at Reduced Capacity



Airport Benchmark Capacities

- Reduced Capacity
- Optimal Capacity



Sustaining Capacity Issues

- **Simultaneous Offset Instrument Approaches**
- **Independent arrival streams** to runways separated by 2,500 feet
- **The runway drop zone** – capacity's free fall
Below VMC to CAT I
A softer loss of capability is needed
- **Simultaneous operations** to intersecting runways
Independent
Dependent
- **Noise**



Navigation

**The
Separation
Safety
Triad**

Communications

Surveillance

Communications

VDL transition with data link services

CPDLC on VDL-2 with service provider

When performance degrades, shift
to VDL-3 in major terminal airspace

SATCOM in lieu of VHF

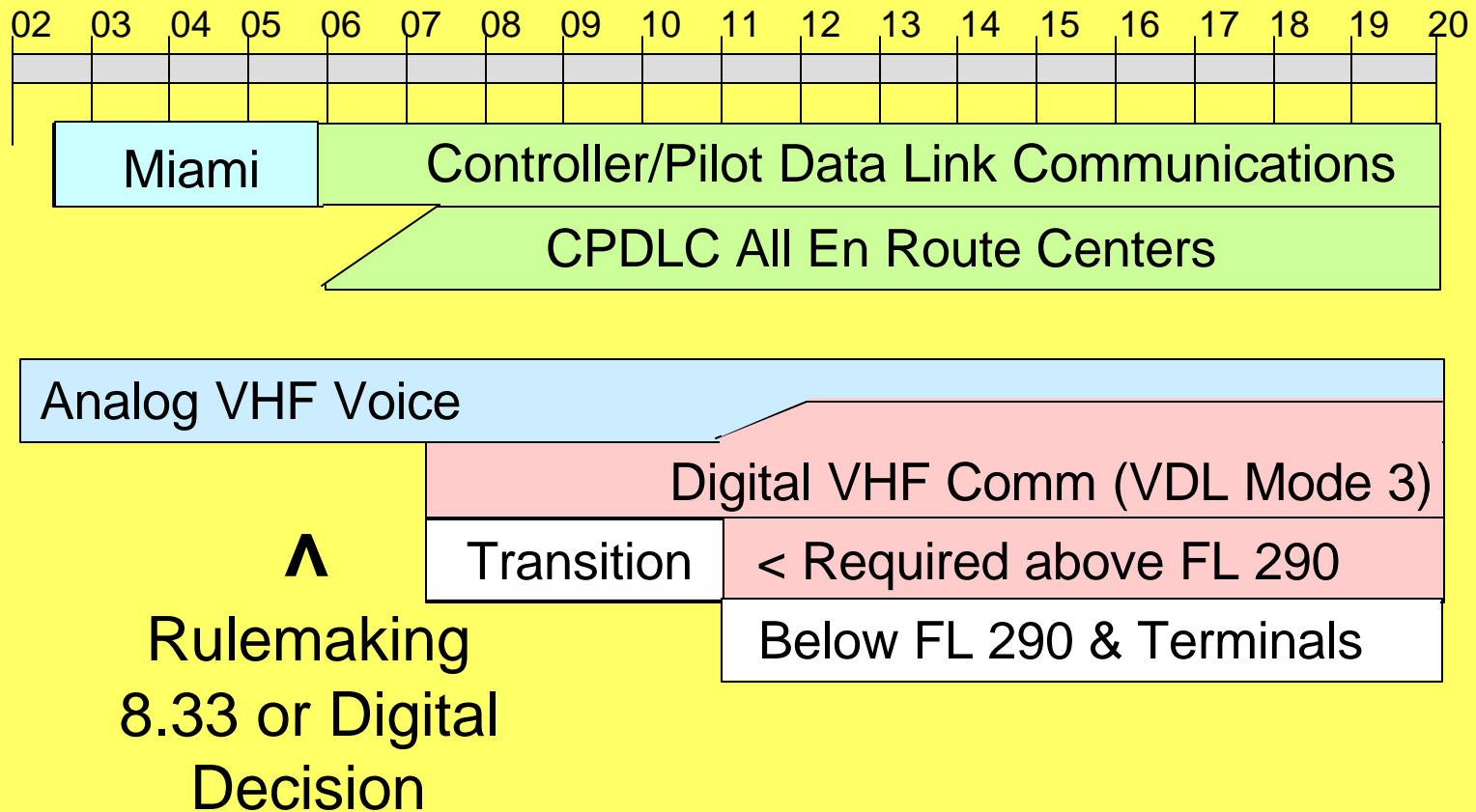
As cost effective as VHF to the Gov't?

SATCOM for ADS

ADS-A via SATCOM or HF data link today

Offshore surveillance coverage

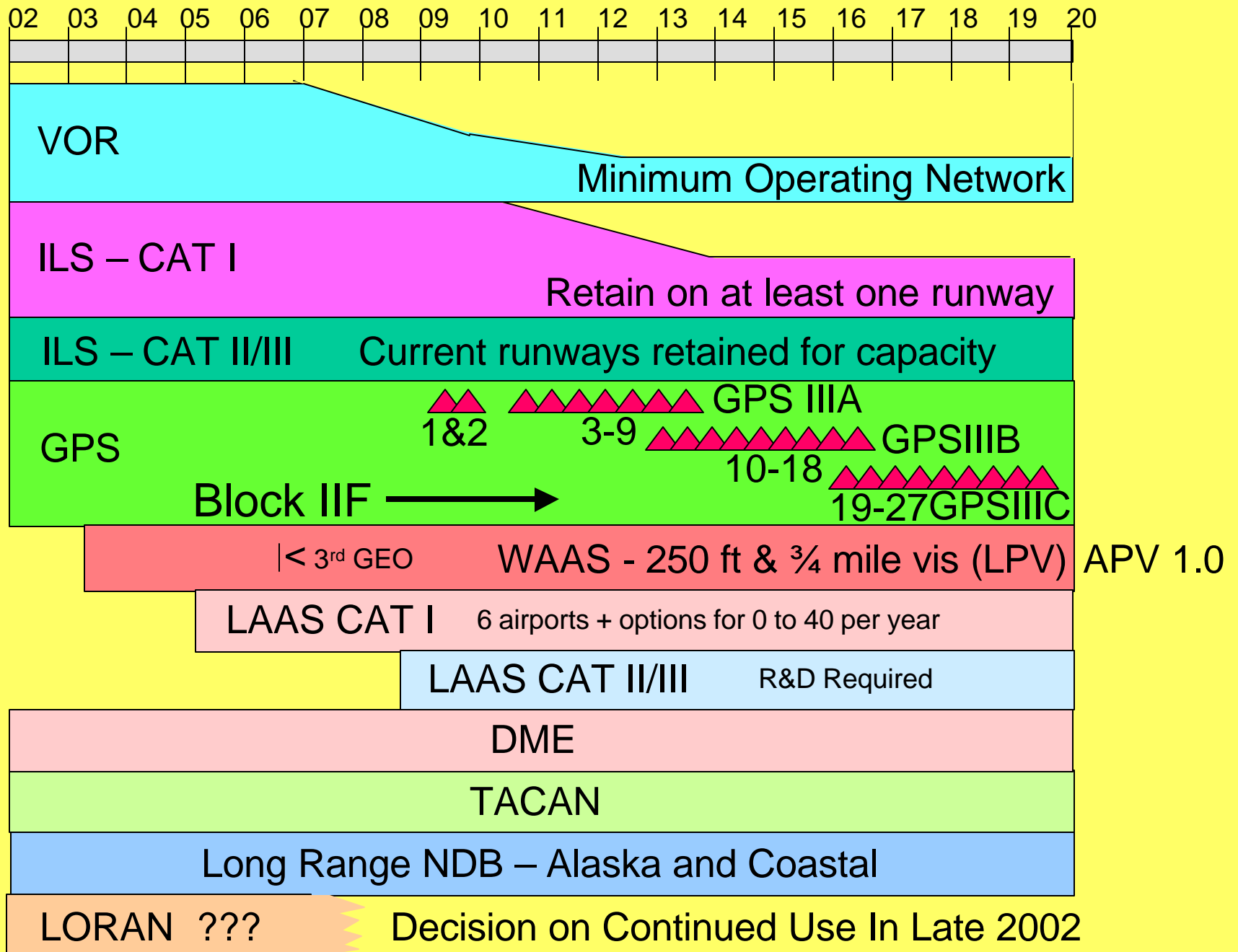
Communications Timeline



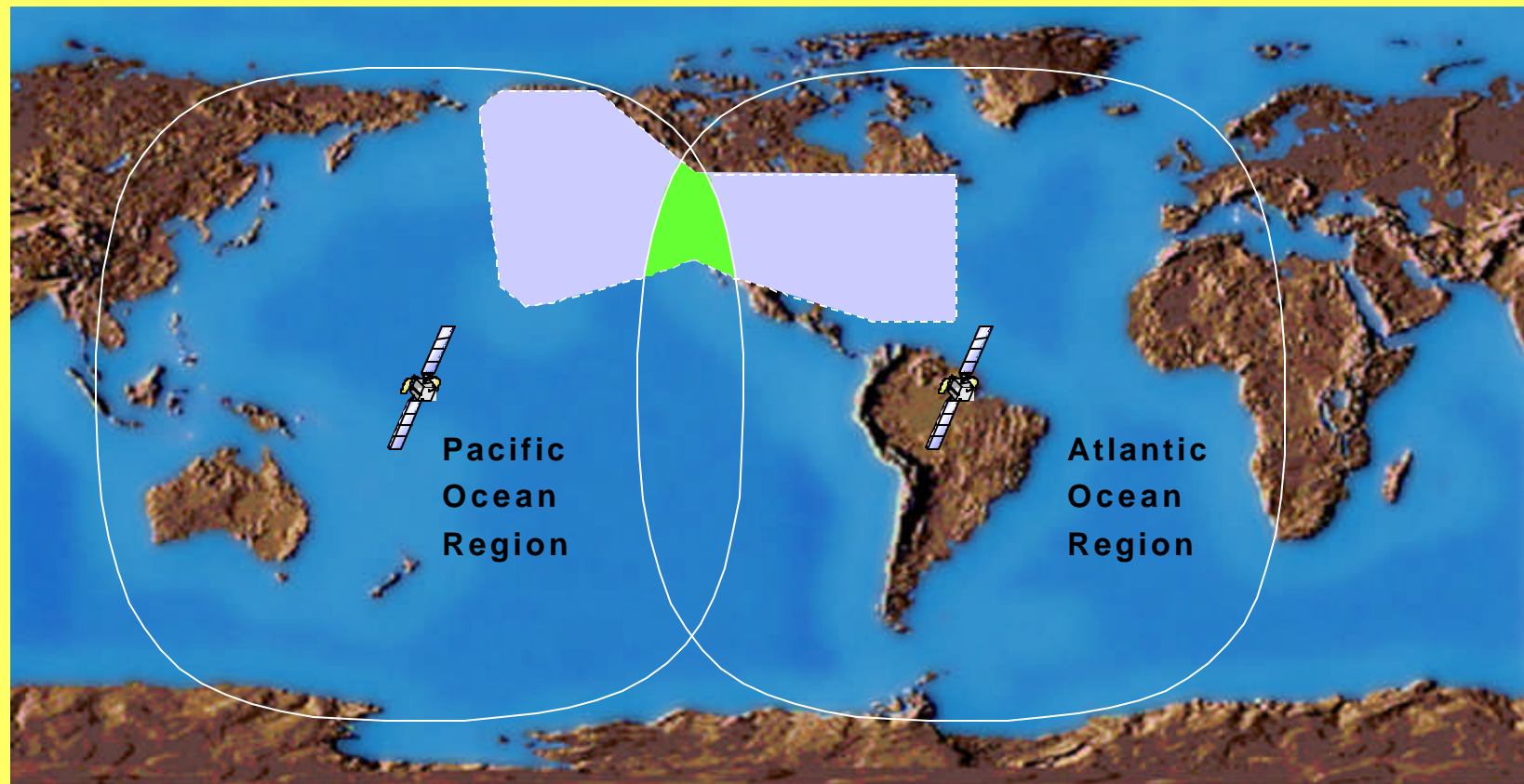
Communications Issues



- Digital transition for voice and data
Incentives for users?
Exclusionary airspace?
- New applications that increase throughput
- Spectrum purity of use for safety of life protection
Integrated bandwidth use
- Low altitude communications offshore/Alaska
- Cockpit information overload – presenting information that adds to situational awareness, not distracts the pilot

Navigation and Landing Timeline



Need WAAS # 3 GEO GEOSAT Service INMARSAT-3 Coverage

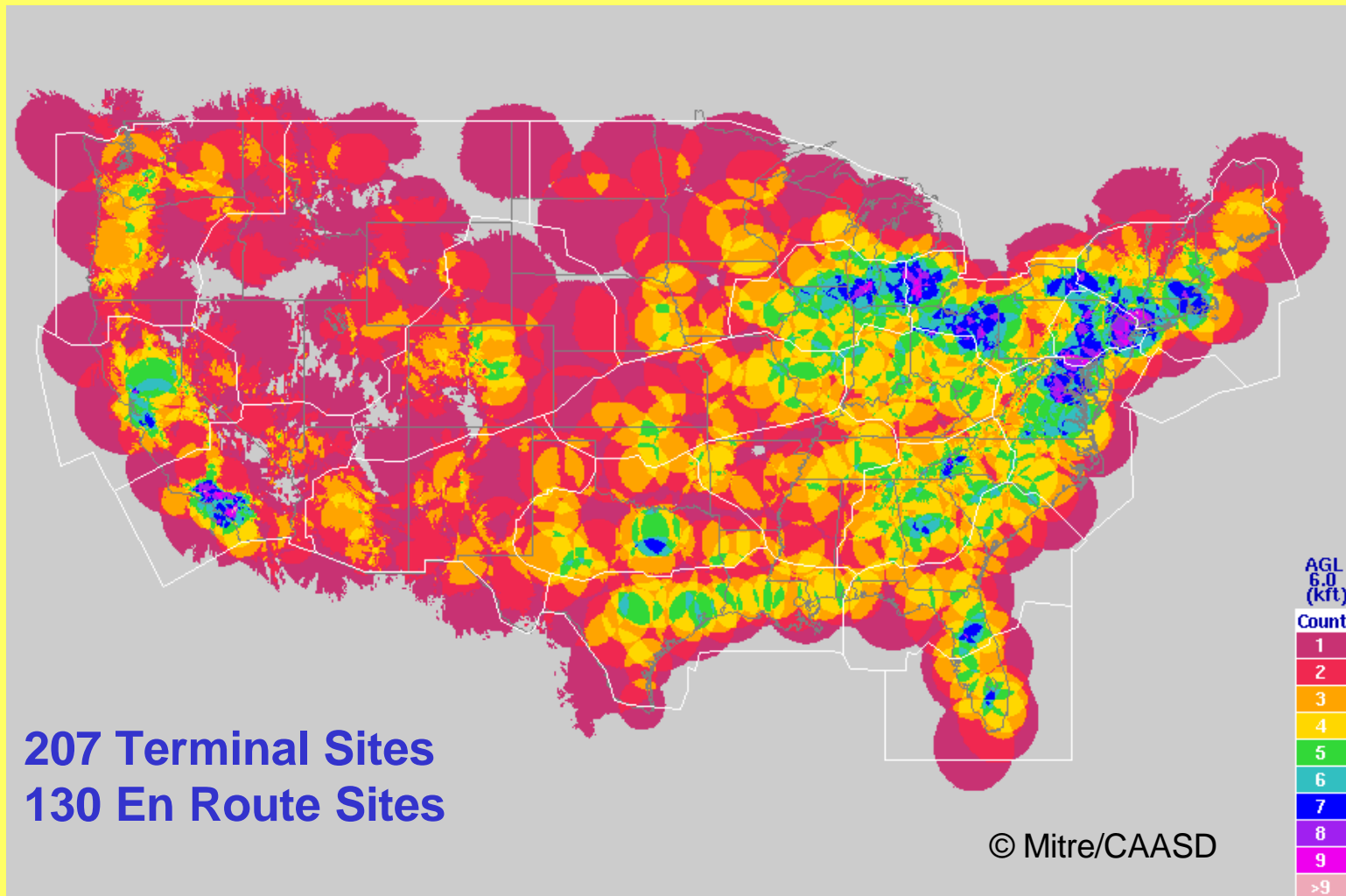


 **Single**  **Dual**
POR (180 W) **AOR-West (55.5 W)**

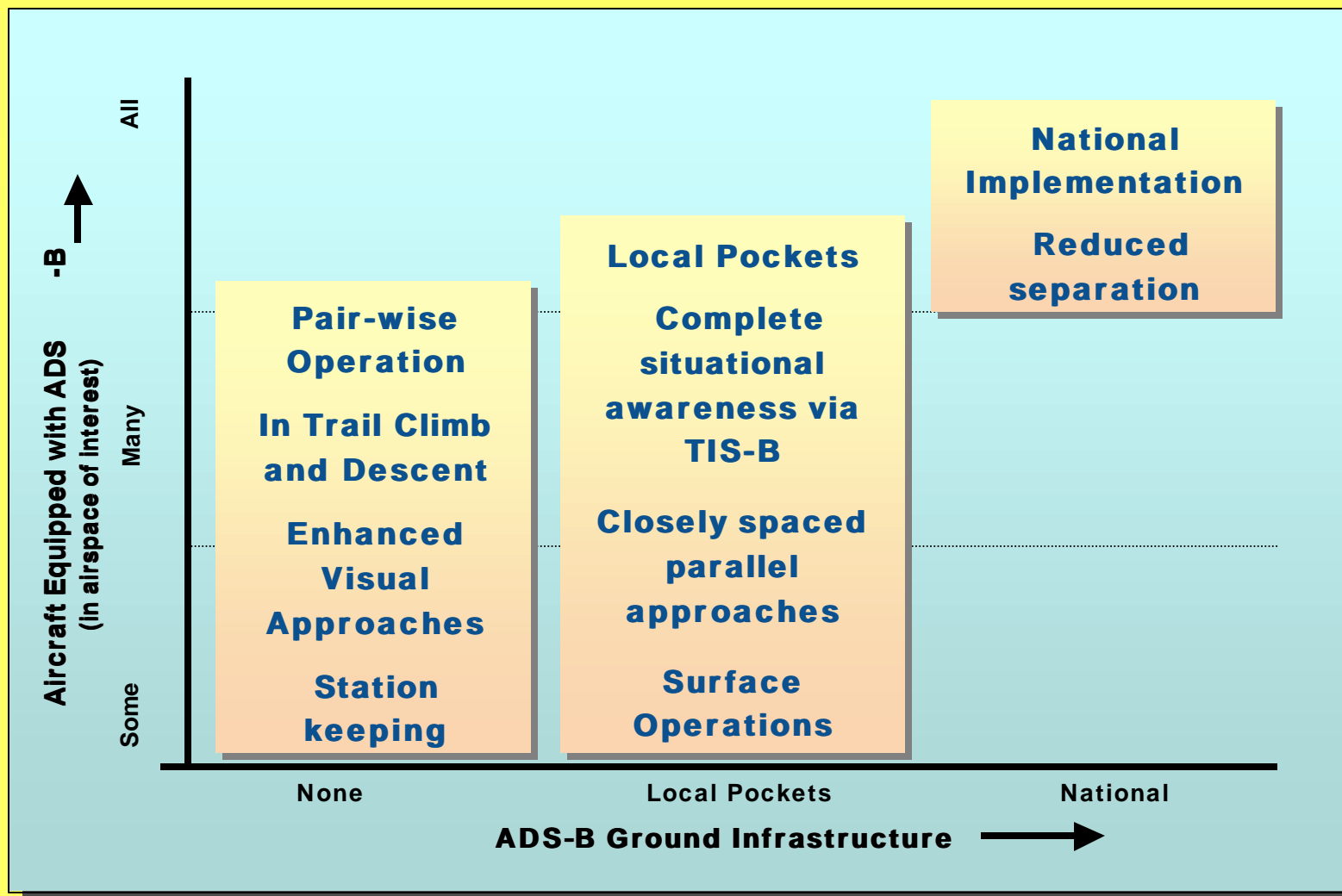
Navigation Issues

- Backup to GPS
What's it going to be?
- Controller workload during interference
- LAAS CAT II/III
If ILS CAT II/III retained as backup it erodes
benefits of LAAS
- RNAV/RNP
Advanced approaches more important than CAT II/III
in terms of benefits
FMS differences problematic to RNP
- “Seek and destroy” GPS interference sources
Satellite detection and ranging of interference?

All FAA SSR LOS Coverage Estimate 6k ft Above Ground Level Coverage Count



ADS-B Transition and Benefits Profile



ADS-B National Deployment

- Provide ADS-B position, velocity, and (possibly) intent data to en route, terminal, and airport surface ATC facilities

Operational Domain	Number of Locations
Airport Surface	59
Terminal	59
En Route w/ Radar Coverage	90 - 110
En Route w/o Radar Coverage	20 - 40

- Other capabilities to be provided:
 - Traffic Information Service-Broadcasts (TIS-B)
 - Multi-lateration for surveillance of those aircraft on the surface that are equipped only with Mode A/C/S transponders

Surveillance Issues

- **Homeland Defense requirements are TBD**
 - Federal networking of surveillance information
 - Improved separation on approach and landing
 - Surveillance Fusion
- **ADS-B**
 - Link Decision
 - Who gets credit for the benefits?
ADS-B or Multi-lateration
 - En route benefits elusive
 - Terminal benefits limited by pilot and controller roles and responsibilities
- **Gulf of Mexico Surveillance coverage options**

Automation Issues

- **En Route Host Replacement**

Balance between sustainment and new concepts of operations

“Enabling” is not the same as doing

History says “aviation for the next 20 years”

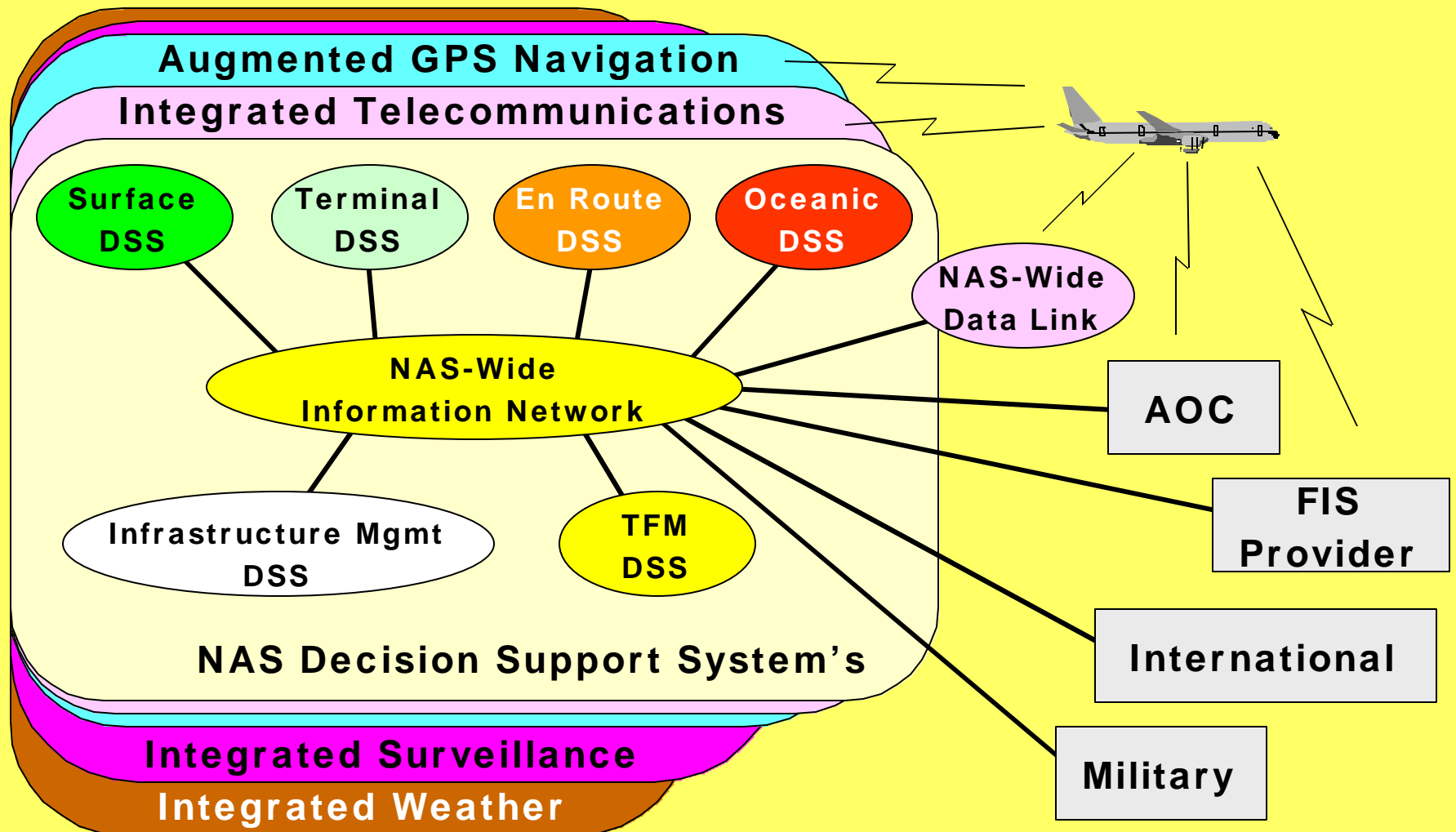
- **NAS-Wide Information System**

The time is right for the flight object

- **Intent**

- Capturing intent changes everything
- Leverages avionics and automation
- Reduces uncertainty

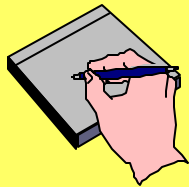
Systems View of the Future CONOPs



Evolution of ATC/ATM

Past

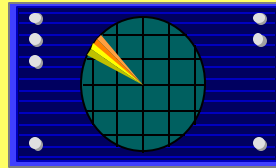
**Procedural
Separation**



**Estimate current &
future aircraft
positions**

Present

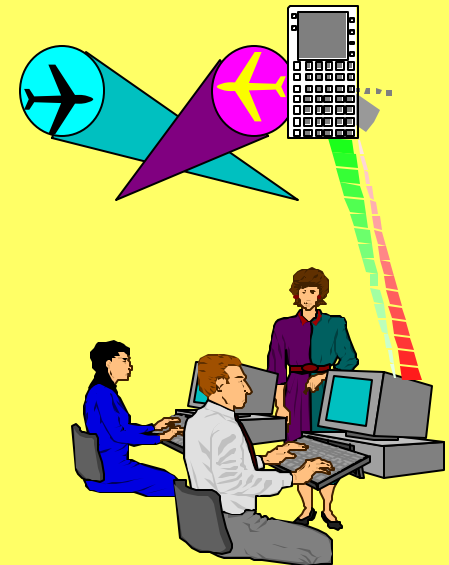
**Radar
Separation**



**Know current &
estimate future
aircraft
position**

Future

**Trajectory
Separation**



**Know
current and
future
positions**

Conclusion:

1. Pause in reinventing avionics
2. Shift focus toward building a better business case through strengthening applications
3. Implement applications
4. Enough new CNS – more use of procedures and intent information linking CNS and Automation
5. Seek niche markets for new capabilities (e.g., Gulf of Mexico)